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CASE STUDY

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Solar Powered Smart Irrigation System

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Abstract: This paper proposes a model of variable rate automatic microcontroller-based irrigation system. Solar power is used as only the source of power to control the overall system. The sensor is placed on paddy field and these sensors continuously sense the water level and give the message to the farmer informing the water level without visiting the paddy fields. Thus, low-cost solar power can be the answer for all our energy needs. Solar powered smart irrigation systems are the answer to the Indian farmer. This system consists of solar powered water pump along with an automatic water flow control using a moisture sensor. It is the convenient solution for the present energy crisis for the farmers. This paper reveals a model of automatic micro controller-based irrigation system. This paper proposes a model of automatic microcontroller-based irrigation system. Here solar energy act as the sole supplier of energy throughout. Sensors are placed on the field and these sensors continuously sense the water level and give the message to the farmer informing the water level without visiting the paddy fields. This paper proposes a model of automatic microcontroller-based irrigation system. This system reduces the cost and increases productivity. This system conserves electricity by reducing the usage of grid power and conserves water by reducing water losses.

Keywords: Smart Irrigation, Energy Crisis, Renewable Energy, Solar Power, IoT Sensors, Soil Moisture Content, Automation

I. INTRODUCTION

Solar energy is the most available source of energy in the world. Energy consumption all over the world is increasing rapidly with the growth of world population. The smart system uses automated drip irrigation and uses the exact water required depending on the soil moisture. In this paper, we are proposing an automatic irrigation system using solar power which operates water pumps to pump water from bore well to a tank and the outlet valve of tank is automatically control by using controller and moisture sensor to control the flow of water from the tank to the irrigation field which helps in optimizing the use of water. It can be a proper alternative for the farmers in this present state of energy crisis. It conserves water by reducing water losses and conserve electricity by reducing the usage of power. The paper is divided into ten sections. ten sections are as follows literature survey and background study, existing system, proposed system, block diagram, flow chart, hardware requirement, software requirements, result, conclusion and future work.

II. LITERATURESURVEYANDBACKGROUND STUDY

According to the survey conducted by the Bureau of Electrical Energy in India in 2011, there are around 18 million agricultural pumps set and around 0.5 million new connections per year is installed with average capacity 5HP. Total annual consumption in agriculture sector is 131.96 billion KWh (19% of total electricity consumption). As solar powered smart irrigation technique is the future for the farmers and a solution for energy crisis. So, for the proposed solar powered system we are using techniques analyzed in and modified. Sine PWM technique has been Used for inverter operation for minimum harmonics as given which further increases the efficiency of the system The rating of the system was calculated corresponding to the pump specifications referring to paper.

III. EXISTING SYSTEM

Presently days the sunlight-based board is broadly utilized yet we can't get the full vitality from sun because of stable situation of panel. Sun following sun powered board is used. It was actualized by utilizing different other algorithms. Agriculture is the wellspring of living of lion's share Indians and it additionally impacts economy of the nation. The goal of our undertaking is to diminish this manual association by the rancher by utilizing a computerized water system framework which object is to improve water use for agricultural yields. The motivation for this venture originated from the nations where economy depends on farming and the climatic conditions prime to deficiency of downpours and shortage of water. The farmers working in the homestead lands are just subject to the down pour sand borewells for water system of the land. Regardless of whether the homestead land has a water pimp, manual association by farmers is required to turn the pump on/off when required. The venture is proposed to develop a programmed water system framework which controls the pump engine ON/OFF on detecting the dampness substance of the dirt. In the field of agribusiness, utilization of fitting system of water system is fundamental.

The upside of utilizing this method is to lessen human intercession and still affirm appropriate water system. A product application was created by foreordaining the edge estimations of soil dampness, temperature and water level that was modified into an arm controller. This paper presents the dirt dampness content. As we realize that Indian economy is one of the biggest creating economies of the world. The rural area has its biggest commitment in the Indian economy. To accomplish most extreme usage of labor and to get greatest benefit in a given stipulated there is a need in the upgradation of different building strategies that are being utilized today. Consequently, keeping up legitimate measure of water level in the dirt is one of the fundamental prerequisites to gather a decent harvest that can be a wellspring of different sorts of supplements whether small scale or full scale for their appropriate development. On the off chance that we talk about Indian farmers they are most exceedingly terrible hit by the starvations that happens because of disappointment of harvests relying on different dry season factors. Downpour assumes the key job in choosing the fate of these yields just as the farmers consistently. The over use of ground water has radically decreased the ground water level in the last 15 years. So, it is the need of hour to use every single drop of water shrewdly with the goal that it can likewise be utilized by our coming ages moreover.

IV. PROPOSEDSYSTEM

This paper has proposed a programmed framework utilizing solar power for the board control. In this system all the information that are received from the sensors and the various parameters are given to the Arduino UNO as an analog input. The circuit board runs completely with solar energy. A preset value of soil moisture sensor is fixed in microcontroller and was programmed. When it goes beyond the particular threshold value, water is automatically irrigated to the plots and once the required amount of water is supplied, pump stops. The solenoid valve is used because a field has many partitions and every partition has different water demands. So, at the beginning of every partition there is a solenoid valve connected to the pipe line to stop the water supply of that particular partition. Here, the depth sensor or ultrasonic sensor plays a crucial role by detecting the water level in the well or storage tank. If the water level is sufficient then only the relay will trigger and the pump will turn ON otherwise if the level is lower than the desired value then the relay will not trigger and the pump will remain OFF to prevent the dry run condition. It is additionally proficiently used to control the water system framework for horticulture and household plants. The LCD displays the Soil Moisture content in percentage as “M1” and “M2”. On the second row it displays, water level in cm as “lvl” and pump condition whether it is ON or OFF as“PMP”.

V. BLOCK DIAGRAM

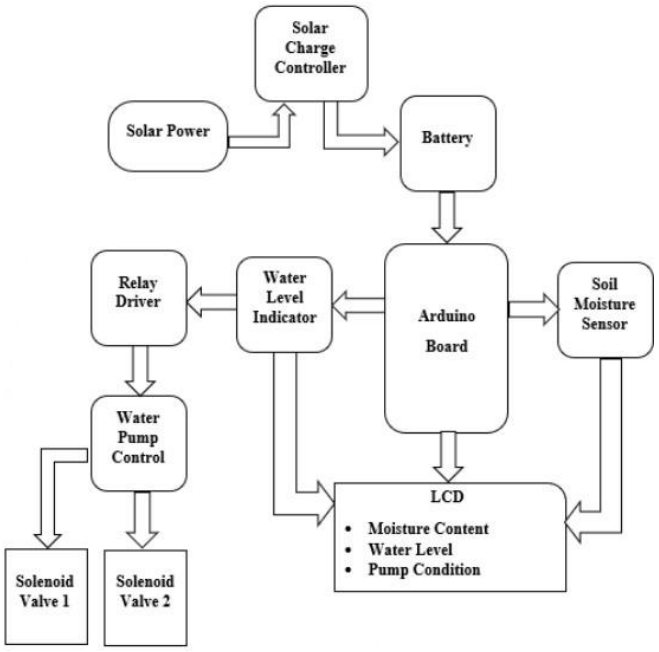

Figure 5.1: Block Diagram of Smart Irrigation System

VI. FLOWCHART

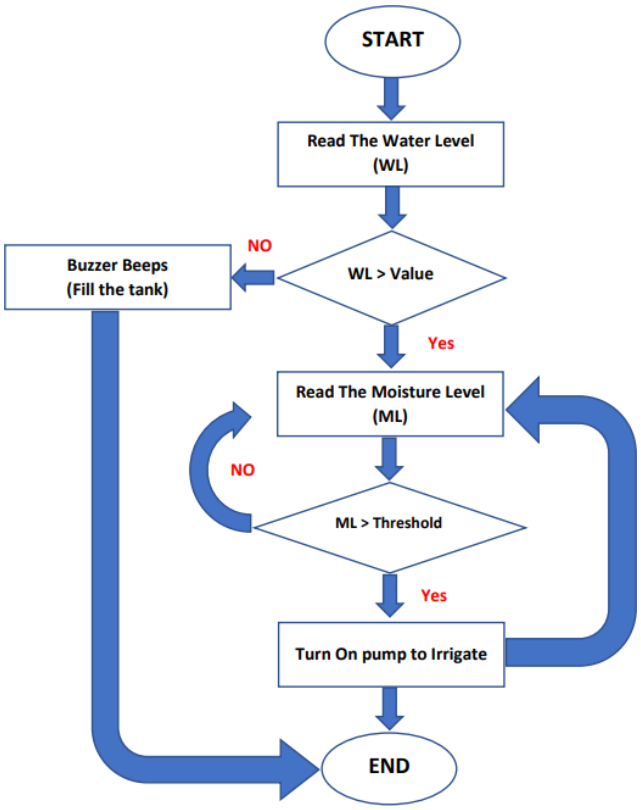

Figure 6.1: Flow Chart of Smart Irrigation System

VII. HARDWAREREQUIREMENT

ARDUINO UNO: - The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.
The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-voltbattery.

Ultrasonic Sensor (HC – SR04): - Ultrasonic sensors are used around the world, indoors and outdoors in the harshest conditions, for a variety of applications. Our ultrasonic sensors, made with piezoelectric crystals, use high frequency sound waves to resonate a desired frequency and convert electric energy into acoustic energy, and vice versa. Sound waves are transmitted to and reflected from the target back to the transducer. Targets can have any reflective form, even round. Certain variables, such as target surface angle, changes in temperature and humidity, and reflective surface roughness, can affect the operation of the sensors.

Soil Moisture Sensor: - A soil moisture sensor is used to measure the volumetric water content of soil. The sensor used in the project is shown below. It consists of two prongs, which must be inserted in the soil, an LM358, which acts as a comparator and a pot to change the sensitivity of the sensor. If the soil moisture sensor is not available, the following circuit can be used as an alternative. It has a fixed sensitivity. This can be changed by implementing a pot in place of one of the resistors connected to the non-inverting terminal of the comparator.

5V Relay Module: - Relay is one kind of electro-mechanical component that functions as a switch. The relay coil is energized by DC so that contact switches can be opened or closed. A single channel 5V relay module generally includes a coil, and two contacts like normally open (NO) and normally closed (NC). This article discusses an overview of the 5V relay module & it's working but before going to discuss what is relay module is, first we have to know what is relay and its pin configuration. The pin configuration of the 5V relay is shown below. This relay includes 5-pins.

DC Pump: - The water pump is used to artificially supply water for a particular task. It can be electronically controlled by interfacing it to a microcontroller. It can be triggered ON/OFF by sending signals as required. The process of artificially supplying water is known as pumping. There are many varieties of water pumps used. This project employs the use of a small water pump which is connected to a H-Bridge. The pumping of water is a basic and practical technique, far more practical than scooping it up with one's hands or lifting it in a hand-held bucket. This is true whether the water is drawn from afresh source, moved to a needed location, purified, or used for irrigation, washing, or sewage treatment, or for evacuating water from an undesirable location. Regardless of the outcome, the energy required to pump water is an extremely demanding component of water consumption. All other processes depend or benefit either from water descending from a higher elevation or some pressurized plumbing system.

Solenoid Valve
A solenoid valve is an electrically controlled valve. The valve features a solenoid, which is an electric coil with a movable ferromagnetic core (plunger) in its center. In the rest position, the plunger closes off a small orifice. An electric current through the coil creates a magnetic field. The magnetic field exerts an upwards force on the plunger opening the orifice. This is the basic principle that is used to open and close solenoid valves

VIII. SOFTWARE REQUIREMENTS

Arduino IDE: - The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of

menus. It connects to the Arduino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righth and corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

IX. RESULTS

By implementing the proposed system there are various benefits for the government and the farmers. For the government a solution for energy crisis is proposed. By using the automatic irrigation system, it optimizes the usage of water by reducing wastage and reduce the human intervention for farmers. The excess energy produced using solar panels can also be given to the grid with small modifications in the system circuit, which can be a source of the revenue of the farmer, thus encouraging farming in India and same time giving a solution for energy crisis. Proposed system is easy to implement and environment friendly solution for irrigating fields. The system was found to be successful when implemented for bore holes as they pump over the whole day. Solar pumps also offer clean solutions with no danger of borehole contamination. The system requires minimal maintenance and attention as they are self-starting. To further enhance the daily pumping rates tracking arrays can be implemented. This system demonstrates the feasibility and applications of using solar PV to provide energy for the pumping requirements for sprinkler irrigation. Even though there is a high capital investment required for this system to be implemented, the overall benefits are high and in long run this system is economical.

X. CONNECTION DIAGRAM

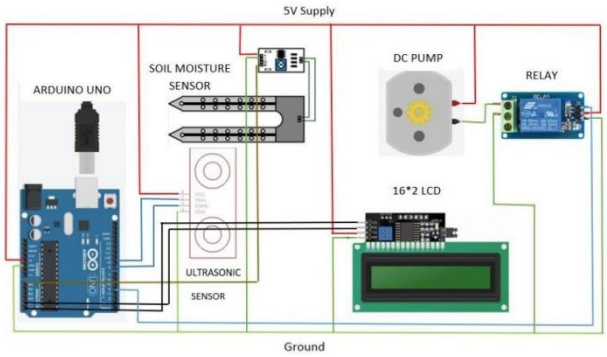

Figure 10.1: Connection Diagram of Smart Irrigation System

XI. CONCLUSION AND FUTUREWORK

In this proposed system a solar powered sensor base automated irrigation model is proposed. We designed this model considering low cost, reliability, alternate source of electric power and automatic control. As the proposed model is automatically controlled, it will help the farmers to properly irrigate their fields. The model always ensures the sufficient level of water in the soil. Thus, this system avoids over irrigation, under irrigation, top soil erosion and reduce the wastage of water. Solar power provides sufficient amount of power to drive the system. To overcome the necessity of electricity and ease the irrigation system for our farmers, the propose model can be a suitable alternative.

The main applications for this project are for farmers and gardeners who do not have abundant time to water their crops/plants. It also covers those farmers who are wasteful of water during irrigation. The project can be extended to greenhouses where manual management is far and few in between. The principle can be extended to create completely automated gardens and farmlands. Collective with the principle of rain water harvesting, it could lead to massive water savings if applied in the right way. In agricultural International Journal of Engineering Science and Computing, April 2017, lands with severe shortage of rainfall, this model can be effectively applied to attain great results with most types of soil.

II. REFERENCES

[1] N. Putjaika, S. Phusae, A. Chen-Im, P. Phunchongharn and K. Akkarajitsakul, "A control system in an intelligent farming by using arduino technology," 2016 Fifth ICT International Student Project Conference (ICT-ISPC), Nakhon Pathom, 2016, pp. 53-56.

[2] Abdullah, S. A. Enazi and I. Damaj, "AgriSys: A smart and ubiquitous controlledenvironment agriculture system," 2016 3rd MEC International Conference on Big Data and Smart City (ICBDSC), Muscat, 2016, pp. 1-6.

[3] S.Muhammad Umair, Automation of Irrigation System Using ANN based Controller, International Journal of Electrical & Computer Sciences IJECS-IJENS Vol:10 No:02, 104602-5757 IJECS-IJENS © April 2010 IJENS.

[4] SANJUKUMAR, “Advance Technique for Soil Moisture Content Based Automatic Motor Pumping for Agriculture Land Purpose”, International Journal of VLSI and Embedded Systems-IJVES, Vol 04, Article 09149; September 2013.

[5] P. B. Chikankar, D. Mehetre and S. Das, "An automatic irrigation system using ZigBee in wireless sensor network," 2015 International Conference on Pervasive Computing (ICPC), Pune, 2015, pp. 1-5.

[6] J. Gutiérrez, J. F. Villa-Medina, A. Nieto-Garibay and M. Á. Porta- Gándara, "Automated Irrigation System Using a Wireless Sensor Network and GPRS Module," in IEEE Transactions on Instrumentation and Measurement, vol. 63, no. 1, pp. 166-176, Jan. 2014.

[7] Chetana A. Kestikar, Automated Wireless Watering System (AWWS), International Journal of Applied Information

Systems (IJAIS) – ISSN: 2249-0868, Volume 2– No.3, February 2012.

[8] J. John, V. S. Palaparthy, S. Sarik, M. S. Baghini and G. S. Kasbekar, "Design and implementation of a soil moisture wireless sensor network," 2015 Twenty First National Conference on Communications (NCC), Mumbai, 2015, pp. 1-6.

[9] G.M. Tina, S. Gagliano, G. Graditi, A. Merola,2012 "Test endorsement of a probabilistic model for evaluating the twofold rotate PV following imperativeness creation," Applied Energy, vol. 97, pp. 990-998

[10] Kabalci, Ersan, Gorgun A. besides, Kabalci Y., 2013."Design and use of a reasonable force source checking system."Power Engineering, Energy and Electrical Drives (POWERENG), Fourth International Conference on.IEEE.

[11] Keyur K Patel,Sunil M Patel,2016, "Web of Things-IoT: Definition, Characteristics, Architecture, Enabling Technology, Applications and Future troubles", IJESC, Vol 6 Issue no:5.

[12] L.V. Hien, Q.P. Ha, V.N. Phat,2009, "Consistent quality and modification of traded direct interesting systems with time deferment and vulnerabilities," Applied Mathematics and Computation, vol. 210, pp. 223-23.

[13] L.L. Oo, N.K. Hlaing,2010 "Microcontroller-based two-center point daylight based after structure", Proc. IEEE second overall assembling on PC inventive work, pp. 436-440.

[14] Malla.S. G and C.N. Bhende,2014, "Voltage control of stay lone breeze and daylight-based imperativeness structure", International Journal of Electrical Power and Energy Systems, vol. 56, pp. 361-373. A Study of IoT based Solar Panel Tracking System 545.

[15] M.D. Phung, T.T.V. Nguyen, T.H. Tran, Q.V. Tran,2013, "Restriction of Networked Robot Systems Subject to Random Delay and Packet Loss", The 2013 IE EE/ASME International Conference on Advanced Intelligent Mechatronics, pp. 1442 1447.

